VIA FACSIMILE TRANSMISSION 571-273-8300

Docket No. 135271
PATENT

REMARKS

Claims 1-25 were originally presented in the present application and remain pending. It is respectfully submitted that the pending claims define allowable subject matter.

With respect to the objections to the disclosure and claim 10, it is believed that the above claim amendments overcome these objections.

Claims 1-4 and 20-23 are rejected under 35 USC 103(a) as obvious over Fraser (USP 6375617) in view of Miller et al (USP 6679849). Claims 5-20 and 24-25 are rejected under 35 USC 103(a) as being unpatentable over Fraser in view of Miller et al alone as applied to claim 1 above, or further in view of Petrofsky et al (USP 5573001). Applicants respectfully traverse these rejections for reasons set forth hereafter.

Claim 1 defines a sub-aperture transceiver system to be housed in an ultrasound probe. The claim clearly defines the signal processor to be located in a probe housing, and the receive aperture outputs to be output from the probe housing. It is submitted that neither Fraser nor Miller teach or suggest any such structure. The entire beamformers of Fraser and Miller are provided at the system, remote from and not within the ultrasound probe. Figure 1 of Fraser clearly illustrates the beamformer 36 to be located at the opposite end of cable 11 from the probe 26. Nowhere in Fraser does it suggest that any portion of the beamforming operations, let alone the signal processing operations such as in claim 1, should be performed within a signal processor located within the probe 26. Miller fails to make up for the deficiencies of Fraser. Each of Miller's beamforming operations are entirely performed at the ultrasound system, not within the probe. The circuitry illustrated in Figures 5(1) – 5C of Miller is entirely provided at the ultrasound system in the electronics box 20 as shown in Figure 1. Thus, neither Fraser nor Miller teach or suggest performing the claimed sub-aperture transceiver operations at a signal processor located in the ultrasound probe.

Claim 10 recites a sub-aperture transceiver system that includes first and second processing boards that are joined in a chained arrangement serially with one another. Claim 10 further defines the first processing board to transfer data serially to the second processor board which outputs first and second receive data serially. It is submitted that the prior art fails to teach any such combination of processing boards. Fraser does not provide any detailed discussion of the signal processors that are used to process ultrasound signals.

Miller describes a parallel processing system in connection with Figure 5B and at column 13. Figure 5B of Miller illustrates a transducer array 42 having transmit sub-arrays 43 and receive sub-arrays 44. Each transmit sub-array 43 and each receive sub-array 44 is joined to a separate and distinct transmit and receive beamforming channel 215 and 225, respectively. As shown in Figure 5, during receive, the receive beamformer channels 225 are joined at a summing element 230 and then provided to an image processor 250. The control processor 140 controls the delays of the summing element 230 to provide a single resulting beamformer signal that represents one ultrasound beam synthesized along one receive scan line (column 13, lines 58-64).

In contrast, the claimed receive apertures and the first processing board produce and transfers first receive data from the corresponding set of receive apertures serially to the second processing board which passes on the first receive data. Neither Miller nor Fraser teach or suggest any serial transfer of data between multiple processing boards.

Claim 21 recites a method in an ultrasound system for sub-aperture processing. The method includes, receiving at a signal processor located in an ultrasound probe, a plurality of receive signals from acoustic transducer elements that comprise a receive aperture. The method further includes multiplexing, within the ultrasound probe, at least one of the acoustic transducer elements between the receive and transmit apertures. The systems of Fraser and Miller do not teach or suggest providing signal processors or performing the operations associated therewith within an ultrasound probe. Nor do Fraser or Miller teach or suggest performing multiplexing between transmit and receive apertures within the ultrasound probe. To the extent Fraser or Miller perform signal processing and multiplexing, such functions are performed at the system which is remote from the probe.

Petrofsky fails to make up for the deficiencies of Fraser and Miller. Petrofsky describes a receive beamformer with phased sub-arrays. However, the system and methods performed by Petrofsky are performed at the system, not within the ultrasound probe. Petrofsky's system is silent with respect to any serial connection between signal processors. Instead, Petrofsky only performs parallel processing, followed by a summing operation to perform beamforming.

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In view of the foregoing comments, it is respectfully submitted that the pending claims define allowable subject matter. Should anything remain in order to place the present application in condition for allowance, the Examiner is kindly invited to contact the undersigned at the telephone number listed below.

Respectfully submitted,

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